

# **Risk Management/Cleanup Decisions at Closed Bombing Ranges, Achieving Consensus Between DOD and State Regulators**

Authors:

Mr. Jeff Edson, Federal Facilities Manager, Remediation and Restoration Unit, Colorado Department of Public Health and Environment

Mr. C. David Douthat, P.E., CSP, Director, Ordnance and Explosives, U.S. Army Corps of Engineers, Huntsville Engineering and Support Center; Safety Fellow, Army Environmental Policy Institute

## **Introduction**

The Department of Defense property account represents approximately 25 million acres of land within the United States. These lands are utilized for a variety of activities to train and support our military.

Training of our military in part includes utilization of ranges and training areas for testing weapon systems as well as training troops in wartime doctrine. Within the Formerly Used Defense Sites (FUDS) Program there are an estimated 900 sites that have the potential for Unexploded Ordnance (UXO) contamination. The areas containing UXO on active DOD properties as well as FUDS properties represent potentially millions acres of land that have the potential for UXO contamination. Today's technologies for locating and removing UXO are labor intensive, time consuming and ultimately very expensive all which represents a unique challenge for the nation. The State and DOD share common goals and objectives for response actions for UXO contamination. Both entities desire to:

- Maintain public safety at the highest possible level,
- Insure timely responses to lands that contain UXO,
- Encourage public participation,
- Utilize the best technology for detection and removal,
- Ensure cost effective and efficient response actions,
- Maintain an effective risk management program for the sites, and
- Ensure Force readiness through a balance of operational needs, explosives safety and environmental stewardship.

Although the States and the DOD share these common goals, there are certain regulatory and legal issues and obstacles that must be addressed by the parties. This paper will detail the cooperative effort that must happen to ensure that the agencies are successful in these goals. A case study of a FUDS property, Former Lowry Bombing Range (FLBR), CO will be used to describe the challenges and successes.

<b>Report Documentation Page</b>			<i>Form Approved OMB No. 0704-0188</i>		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>AUG 1998</b>	2. REPORT TYPE	3. DATES COVERED <b>00-00-1998 to 00-00-1998</b>			
4. TITLE AND SUBTITLE <b>Risk Management/Cleanup Decisions at Closed Bombing Ranges, Achieving Consensus Between DOD and State Regulators</b>		5a. CONTRACT NUMBER			
		5b. GRANT NUMBER			
		5c. PROGRAM ELEMENT NUMBER			
6. AUTHOR(S)		5d. PROJECT NUMBER			
		5e. TASK NUMBER			
		5f. WORK UNIT NUMBER			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Army Corps of Engineers,Huntsville Engineering and Support Center,Huntsville,AL,35807-4301</b>		8. PERFORMING ORGANIZATION REPORT NUMBER			
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)			
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)			
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM001002. Proceedings of the Twenty-Eighth DoD Explosives Safety Seminar Held in Orlando, FL on 18-20 August 1998.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>9</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

## **Site History**

The FLBR is located in Arapahoe County, Colorado, twenty miles southeast of Denver. The area incorporates approximately 60,000 acres and was opened in 1942 as an Army airfield. It was subsequently used as training camps, bombing ranges, gunnery ranges, and other weapons training activities through 1956. Numerous types of munitions potentially remain at the FLBR. These include small, medium and large caliber ammunition, explosive bombs, rockets, guided missiles, detonators, blasting caps, fuzes, boosters, bursters, incendiary materials and practice bombs. In addition to training activities, four Titan Missile Facilities were constructed, operated and closed during the period of 1960-1965. In 1969, the land was transferred to federal, state and private parties.

Throughout this period numerous clearances and range maintenance activities were conducted. In 1991, the city of Aurora, while constructing a reservoir, encountered UXO and hired a UXO contractor to conduct a clearance of the area. Since that time numerous incidents have documented UXO at the site including emergency response actions by the Arapahoe County Sheriffs Department, the U.S. Army EOD and the U.S. Army Corps of Engineers (USACE). In 1992, an Inventory Project Report was completed which provided official documentation of the potential for UXO at this site. Since that period, the FLBR had numerous activities that lead to the Engineering Evaluation/Cost Analysis (EE/CA) and recommended responses actions for the site.

Today the primary land use of the FLBR is agricultural and/or conservation related. In addition, the range has several residential communities and is the home of one of area's largest recreational parks, the Aurora Reservoir.

## **Project Process**

### *Historical Evaluation and Determinations*

In 1991 the USACE completed the Findings and Determination of Eligibility Report which documented that the site was an eligible project under the Defense Environmental Restoration Program. In that same year, the USACE initiated the INPR to provide a qualitative evaluation of the potential hazard(s). The INPR recommended that further investigations should proceed for FLBR. In May 1995, the Corps completed a more detailed study of the site and published its findings in the FLBR Archives Search Report (ASR). Following publication of the ASR the Colorado Department of Public Health and Environment (CDPHE) requested from the Army, immediate attention to this site to protect public safety and health.

### *State Concerns with Historical Evaluations and Determinations.*

The CDPHE was first apprised of the FLBR in September 1995 when Colorado's State Land Board requested assistance in reviewing a USACE document. In the 1960's, the Land Board acquired 28,000 acres of the FLBR for future residential/industrial development. At the time of acquisition, the U.S. government had certified the land cleared of ordnance and safe for unrestricted use. The

report, entitled Defense Environmental Restoration Program for Formerly Used Defense Sites, Ordnance and Explosive Waste Chemical Warfare Materials, Archive Search Report, Buckley Field, May 1995, now classified possible human risks on the State Land Board property as “catastrophic.”

Unfortunately, CDPHE had limited background with unexploded ordnance risks. Instead, CDPHE relied on the precautions of the ASR and informed the Land Board that all activities on the FLBR should be discontinued pending discussions with the USACE.

Discussions with the USACE were discouraging. While the ASR identified the site as catastrophic, obtaining expeditious responses from the USACE was difficult. For the next fifteen months the agencies engaged in ardent discussions on both the technical and legal merits of site cleanup. These included:

October 1, 1995, CDPHE writes a letter to the USACE requesting they “promptly initiate an ordnance project.” CDPHE’s primary concern was public health at the reservoir and those residents living on the range.

February 9, 1996, the USACE sends letters to over 200 landowners on the FLBR informing them of ordnance risks and warning that intrusive activities on their properties should not be initiated without ordnance clearances.

February 29, 1996, a second request for immediate action is sent to USACE (a formal response to the October request was never received). CDPHE had since discovered that for several years ordnance had been found on the shores of the reservoir. In addition, a local rancher had recently ignited an incendiary munition with his truck, starting his field on fire. CDPHE was now requesting a Time Critical Removal Action (TCRA).

March 12, 1996, the USACE informs CDPHE that funding to perform an EE/CA will be provided in FY97.

May 3, 1996, the USACE informs CDPHE that a TCRA is not justified. In addition, USACE advises CDPHE that the EE/CA is scheduled for 1st quarter of FY 97 and will take between 9 and 21 months to complete.

July 5, 1996, CDPHE notifies USACE of its intent to invoke dispute resolution under Colorado’s Department of Defense and State Memorandum of Agreement (DSMOA). CDPHE’s disputes focus on two concerns: 1) initiation within 90 days of emergency actions (investigations, removal and response actions as necessary) at all sites identified by the ASR as having potential OEW, 2) provision of all information assembled by the USACE regarding the possible use or presence of chemical agent at the bombing range.

July 30, 1996, a first tier dispute resolution meeting with USACE Omaha District failed to resolve the outstanding disputes.

September 24, 1996, a second tier dispute resolution meeting with USACE and CDPHE representatives results in an Agreement in Principle. The Agreement is signed on October 10, 1996.

February 27, 1997, the USACE advises CDPHE that various milestones set out in the Agreement in Principle will not be met. In addition, it becomes evident that differing expectations exist on how characterization and clearances on the FLBR would be performed.

March 1, 1997 through June 1, 1997, numerous meetings, conference calls and correspondence between the agencies failed to resolve the timing and methodology used to characterize the site.

June 10, 1997, CDPHE files an Emergency Compliance Order under the Colorado Hazardous Waste Management Act in Arapahoe County Court. In addition, it files an intent to file suit under Section 7002 of the Resource Conservation and Recovery Act. Finally, CDPHE obtains an administrative warrant to enter and inspect all of the USACE's geophysical data, ordnance logs, maps, field notes, photos, etc.

### *Engineering Evaluation*

Planning for the EE/CA began in the fall of 1996. The EE /CA is a detailed engineering evaluation and analysis that documents and justifies the decision for alternative actions for a site. The EE/CA process is similar to a Remedial Investigation/Feasibility Study (RI/FS) utilized for hazardous and toxic waste sites but has been tailored for UXO sites.

The FLBR was divided into four zones and were prioritized to ensure that the zones that had the highest potential for public exposure were evaluated first. The zoning process and prioritization was accomplished in consultation with the CDPHE. Furthermore, each zone was subdivided to accommodate the statistical sampling techniques that were to be used. A computer-based sampling approach known as SiteStats/GridStats was selected by the Corps as a means to evaluate and quantify potential contamination for the site. The sectors were selected based upon past, current, and future land uses and associated current activities, Once the sectors were selected, sampling grids were randomly selected and placed throughout the sector. Utilizing standard surveying techniques each sector location was permanently captured to support the geophysical mapping process that followed.

The geophysical mapping methods allowed for a non-intrusive controlled investigation. Several methods were evaluated using a geophysical prove-out test grid to determine the type of technology would provide the best detection, discrimination and mapping capabilities. The EM-61 was the selected geophysical instrumentation base upon the performance criteria for anomaly resolution, anomaly location reacquisition and instrument precision. Data quality was continually monitored to ensure that the position of the data collection system was properly recorded, daily documentation of the standardization response was within acceptance range, data represented a complete grid and geophysical reasonableness.

Anomaly locations were identified during the geophysical mapping post processing phase. Anomaly sampling locations within each grid were identified by the locate teams using a total optical laser survey system. The UXO dig teams would conduct the anomaly recovery, document the finding and provide disposition of any recovered UXO.

#### *State Concerns with Engineering Evaluation*

With the signing of the Agreement of Principle in October 1996, CDPHE envisioned a visual/geophysical characterization of the entire 60,000 acres of FLBR surface. In March 1997, the USACE provided CDPHE a work plan outlining the use of SiteStats/GridStats to quantify the nature and extent of UXO. CDPHE understood that the mag and flag approach would not be 100% effective. However, the agency argued that the use of a statistical model could result in significant error if improperly calibrated. CDPHE preferred on-site field work over statistical extrapolation.

CDPHE's concerns with SiteStats/GridStats included: 1) a lack of validation that the models were appropriate for use at the FLBR, 2) inappropriate assumptions used in the model, especially the presumption that UXO was distributed homogeneously across sectors, 3) the small amount of data (less than 1% coverage) used in the models to quantify UXO, 4) extrapolation of a small data base over large tracts of land, and 5) the inability of the statistical model to identify entire impact areas.

#### **Risk Analysis**

A critical element of the EE/CA process is the risk evaluation. The risk evaluation considers the potential public exposure to UXO based upon the statistical sampling results and area demographics. The risk evaluation also allows decision makers to evaluate the effectiveness of response actions relative to UXO risk reductions and cost comparison

The process used to evaluate the public risk at FLBR was OECert. OECert estimates risks based upon the density of UXO, demographics, and activities allowed in a sector. A risk estimate was provided for the following alternatives:

- Alternative 1: No Further Action
- Alternative 3: Surface Clearance
- Alternative 4: OE clearance to depth of one foot
- Alternative 5: OE clearance to depth of four feet (frost depth)
- Alternative 6: OE clearance depth to 12 feet

*Note : Alternative 2: Institutional Controls was not evaluated utilizing OECert,*

The risk estimates were prepared and presented for each of the selected zones and were compared to the OECert analysis at 18 other FUDS and Base Realignment and Closure Sites. This comparative risk results were documented in the zone specific OECert analysis.

#### *State Concerns with Risk Analysis*

OECert was originally developed by the USACE to provide a prioritization tool for OE remediation based on relative risks associated with specific ordnance and the type of activity (or exposure scenario). Recently the USACE made use of this methodology as a measure of risk reduction. CDPHE does not agree that the use of relative and qualitative risk estimation is an appropriate method to define risk reduction. Moreover, CDPHE believed that OECert would underestimate risks because of inappropriate and/or inadequate assumptions used for hazard identification, exposure assessment, risk characterization and uncertainty analysis.

### **Public Involvement**

Public involvement played a substantial role in the process of defining cleanup methods and milestones at the FLBR. In addition, the FLBR's Restoration Advisory Board (RAB) had numerous contacts within local, state and federal politics. Political pressure on both agencies kept resolution of the litigation a priority.

Public involvement became disorganized with the decision by the USACE to continue implementation of the EE/CA while negotiations proceeded. Because the litigation centered on technical issues associated with EE/CA, tense discussions between the agencies arose at RAB meetings. While the USACE presented project status updates of their EE/CA, CDPHE argued that the results were inaccurate and untested because of the model's insufficiencies. The outcome was public frustration with both agencies. The RAB chose to contract with an independent technical expert to assist in its advisory role.

### **Stakeholder Partnerships**

In addition to the public, other stakeholders directly effected by the cleanup of the FLBR included: State legislative representatives, State Land Board Commissioners, County Commissioners, City Council members, County Sheriff's Office, County Parks and Recreation Departments, County Health Departments, City and County Planning Departments and private recreational clubs and industries located on the FLBR. Each stakeholder had unique concerns with the type and timing of the cleanup. A priority of both USACE and the CDPHE during the litigation was to have open and continuous communications with each stakeholder. The biggest challenge, which remains today, is the concerns of the County Parks and Service Department. Can the USACE and CDPHE provide an adequate awareness of the risks of UXO exposure without impacting public use of the Aurora Reservoir due to apprehension of unsafe surroundings? This concern requires considerable coordination between the USACE and representatives of the County.

### **EE/CA Recommended Response Actions**

During the field investigation, 11,022 anomalies within zones 1,2, and 3 were investigated. The results of the investigation are provided in Table 1.

Table 1, Summary of EE/CA Field Activities for Zones 1, 2, and 3

Zone	Total Area (acres)	Area Sampled (Acres)	Anomalies Investigated	Anomalies Containing OE Scrap	OE Scrap Items Found	# of UXO Found
1	11,445	168	4,939	2,709	3,553	40
2	6,527	126	4,614	361	444	1
3	10,680	171	1,469	835	993	0
<b>Totals</b>	<b>28,652</b>	<b>465</b>	<b>11,022</b>	<b>3,902</b>	<b>4,990</b>	<b>41</b>

Based on the results of the geophysical sampling and application of these results to the OECert, the EE/CA recommended response actions for several areas within the three zones. The majority of the three zones received a recommendation of No Further Action. Details of the recommended alternative can be found in the final EE/CA for the FLBR.

#### *State Concern with Recommended Response Actions*

CDPHE argued that SiteStat/GridStat and OECert would result in insupportable response actions. As an example of CDPHE's concern, SiteStat/GridStat estimated up to 1,120 annual public exposures of UXO at the periphery of the Aurora Reservoir. OECert's estimate of risk from this exposure scenario provided for Alternative 1, No Further Action. CDPHE could not agree to the protectiveness of this alternative.

#### **Settlement Agreement**

The Settlement Agreement, signed on April 28, 1998, provides a foundation for cooperation between CDPHE and the USACE regarding the study and remediation of the FLBR. The Settlement Agreement also sets forth a framework for staying the litigation for two years until such time as the agencies move to dismiss the case without prejudice. The stay was used as a substitute for filing the Settlement Agreement with the court, making the terms of the agreement enforceable. Instead, CDPHE, based on the USACE's compliance with the terms of the Settlement Agreement, can dismiss the suit anytime, but no later than the two year time frame.

The principle technical terms of the Settlement Agreement include:

1. The use of Synthetic Aperture Radar (SAR) to, among other things, assist in identifying potential areas of concern, assist in determining the extent of areas of concern and to identify areas that are presumptively clean.
2. A commitment from the USACE to perform, as necessary, anomaly avoidance and construction support and to respond to property owner's requests to identify and remove UXO.

3. A commitment to clear numerous impact areas within the FLBR. The extent of clearance at these impact areas is defined in the Settlement Agreement, but subject to modification based on field investigations. The Settlement Agreement also includes target completion dates for each clearance project.
4. A commitment to geophysically map and identify anomalies at three bomb targets on the FLBR. The mapping will be used to decide the need for and timing of any required clearance. In addition, the mapping will assist in the verification and validation of the SAR technology.
5. A commitment to perform a visual surface reconnaissance to identify surface UXO at other historic impact areas. The total area of investigation will not exceed 2,000 acres.
6. A commitment to seek continued active public/stakeholder involvement.
7. A commitment for the agencies to work together in partnership with the goal of reaching consensus. A schedule of meeting times and dates are included in the Settlement Agreement.

## **Continued Involvement**

The Settlement Agreement calls for a mutual ownership of the site's remediation. Through the Settlement Agreement, the mechanism now exists for unparalleled cooperation between the USACE and the CDPHE. The Settlement Agreement not only promotes, but requires constant communication between the agencies. The relationship between the agencies' Project Managers is unmatched by any other site in the State of Colorado. The drastic change is centered around trust and communication. Unlike the October 1996 Agreement in Principle, this Agreement eliminated miscommunication and mistrust by providing a common goal, along with a clearly defined path necessary to meet that goal.

The State's funding to participate in the FLBR project is provided through Colorado's DSMA. The DSMA is a national program where States provide services to those DoD installations funded under the Defense Environmental Restoration Account (DERA). Those services are reimbursed through a Cooperative Agreement developed between the DoD and the States.

## **Summary**

*The Federal Perspective* - Without question, public and worker safety is the foremost consideration in the evaluation and selection of alternative actions for site contaminated with UXO. As this Nation proceeds with the challenges of remediation of these sites, it must do so in a cooperative manner. In retrospect for the case study at the FLBR, it is apparent that all parties shared similar objectives. If so, why all the delays and legal maneuvering. There is no single answer but from my experience with the entire process, there are guiding principles that must be employed to insure a successful project:

- Partner with the regulatory community - the regulatory community must and ultimately will be part of the solution.
- Encourage active public involvement - the public must be equal partners in the dialogue.
- Effective communication within and among all stakeholders - Recognize community knowledge. Capitalize on the community's energy. The community is most effected by all decisions.

- Agreement by stakeholders of project objectives - All stakeholders should have input to project goals, objectives, expectations and decisions.
- Educate the stakeholders of the technical issues. Don't assume the community does not understand the issues. Provide stakeholders with the tools to participate.
- Openly discuss budget and schedule issues. Insure that all understand that individual projects compete with other projects and programs for federal funds. All must be balanced.

*The State Perspective* - In addition to the perspectives of the Federal government, experience from the negotiations at the FLBR provided valuable lessons on how to, and not to pursue consensus. Additional principles or precautions which may help ensure a cooperative relationship between the two governments and the public, and assist in dispute resolution include:

- Avoid litigation if possible. The time and effort devoted towards preparation of legal strategies, expert witnesses, legal briefs and written testimony would be better spent in negotiation. In addition, once litigation has been pursued, the discussions during negotiations are hindered by legal posturing.
- Understand the financial/contractual processes of the federal government. While State government has convoluted contractual procedures, the federal government's process makes the state's seem rudimentary. Take into account these processes and limitations when developing milestones.
- Attempt to negotiate remedies that limit the burden of cleanup on the future. The negotiations focused on geophysically mapping and/or clearing all known impact areas on the FLBR in the next 2-3 years. The Settlement Agreement only commits the federal government to provide anomaly avoidance support at the FLBR if UXO is discovered or there are changes to land use that may impact the protectiveness of the remedy.
- States should be prepared to provide technical assistance in expediting cleanup, not only in-house expertise, but through technical contractors. The DSMA program will reimburse state contractors if it is agreed by both agencies that their expertise is necessary to the success of the project. States hiring technical contractors may also remove some of the financial burden from the federal government.
- Make sure that the right individuals are present when negotiating technical/legal disputes. Don't negotiate policy issues with technical staff and visa-versa. Especially with the dispute resolution process, define your issues of disagreement and invite meeting attendees accordingly.
- Be aware that negotiated agreements are not finalized without an opportunity for focused and meaningful input by the public. However, expect disappointment from some stakeholders. Each stakeholder's needs are unique and fulfilling all expectations is unlikely.